US009225713B2

(12) **United States Patent**
Kobayashi

(10) **Patent No.: US 9,225,713 B2**
(45) **Date of Patent: Dec. 29, 2015**

(54) **SYSTEM, CONTROL METHOD, AND STORAGE MEDIUM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 180 days.

(21) Appl. No.: **13/905,033**

(22) Filed: **May 29, 2013**

(65) **Prior Publication Data**

US 2013/0340062 A1 Dec. 19, 2013

(30) **Foreign Application Priority Data**

Jun. 1, 2012 (JP) 2012-126189

(51) **Int. Cl.**
H04L 29/06 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 63/0815*** (2013.01)

(58) **Field of Classification Search**
CPC H04L 63/0815; H04L 63/0823; H04L 63/083; H04L 63/0884; G06F 21/41
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2013/0318590 A1* 11/2013 Matsugashita 726/8

FOREIGN PATENT DOCUMENTS

JP 2004-234329 A 8/2004

* cited by examiner

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(57) **ABSTRACT**

The present invention performs control to realize an appropriate access by executing mapping processing of single sign-on by associating SP side user information and IdP side user information using a unique AUID.

9 Claims, 13 Drawing Sheets

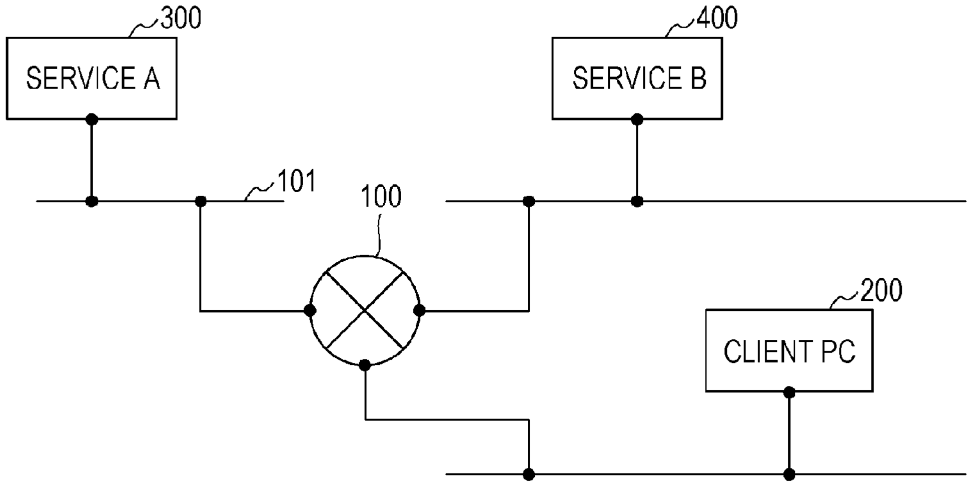


FIG. 1

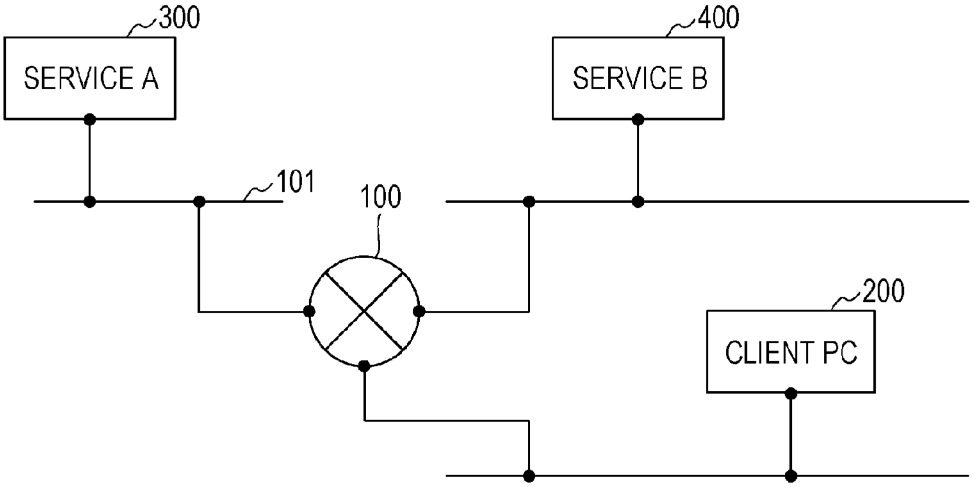


FIG. 2

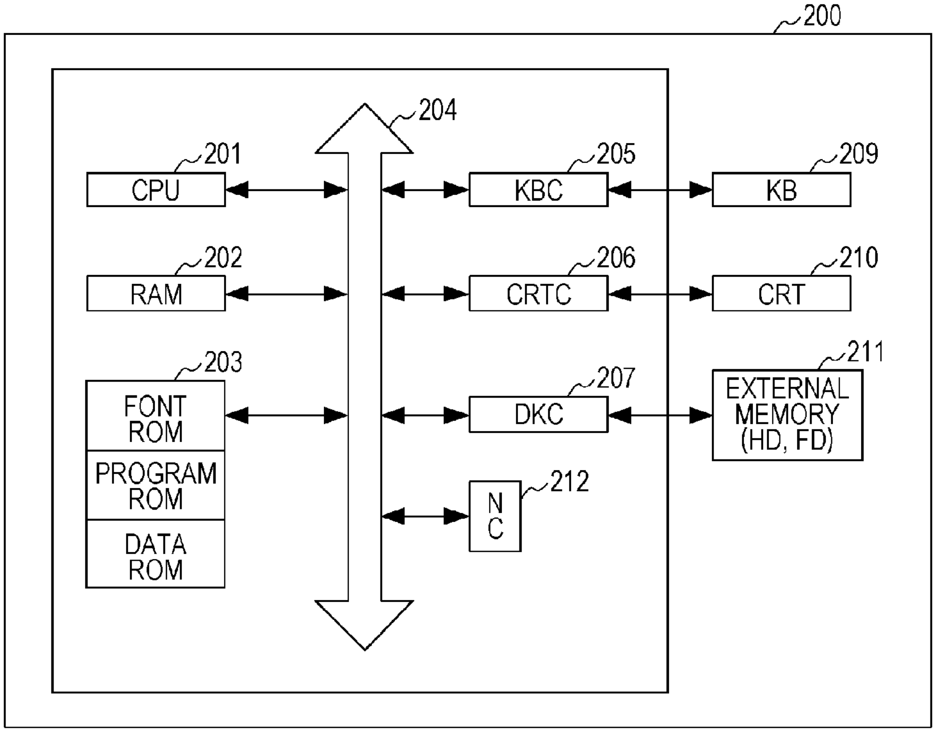

200
204
201
CPU
205
KBC
209
KB
202
RAM
206
CRTC
210
CRT
203
FONT ROM
PROGRAM ROM
DATA ROM
207
DKC
211
EXTERNAL MEMORY (HD, FD)
212
N C

FIG. 3A

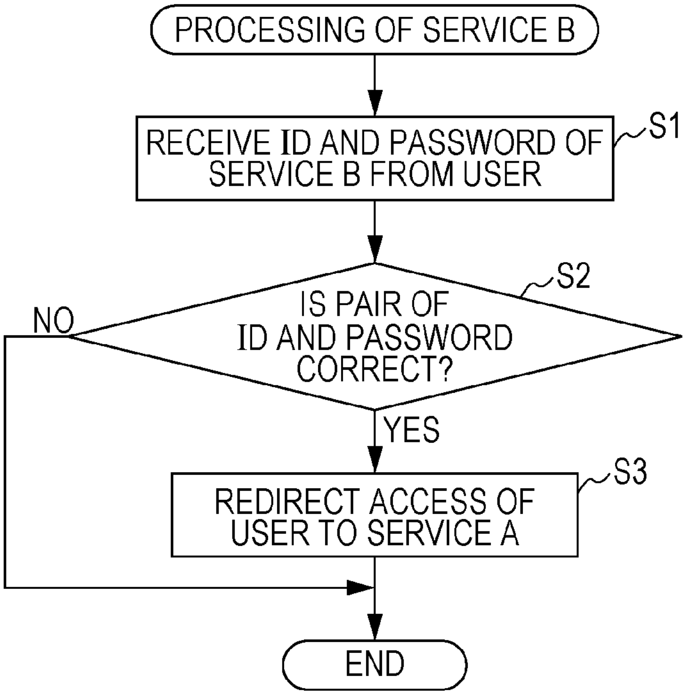

PROCESSING OF SERVICE B
RECEIVE ID AND PASSWORD OF SERVICE B FROM USER
S1
IS PAIR OF ID AND PASSWORD CORRECT?
S2
NO
YES
REDIRECT ACCESS OF USER TO SERVICE A
S3
END

FIG. 3B

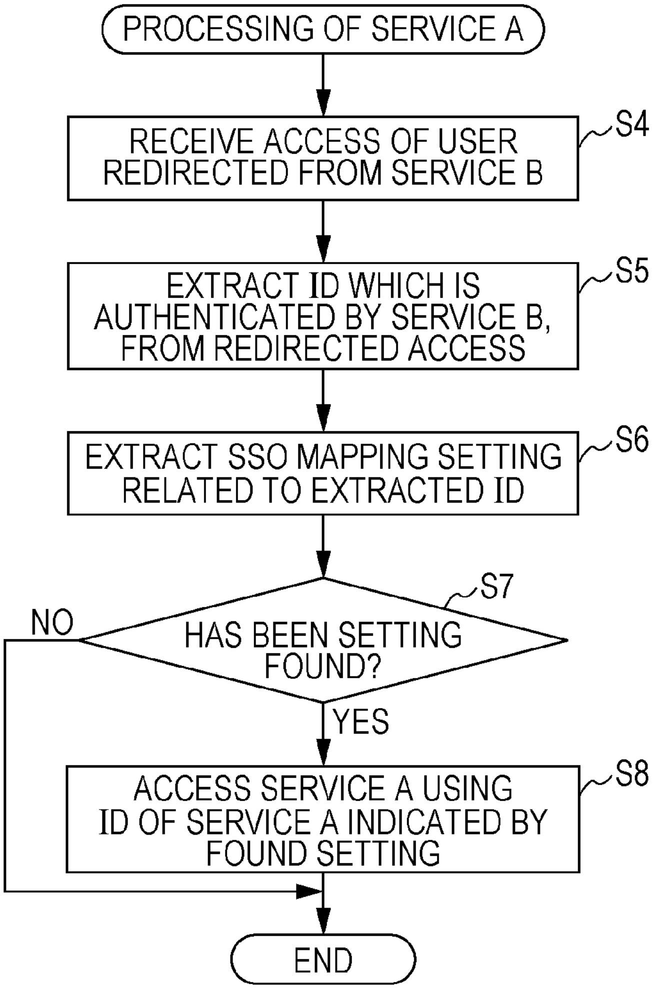

PROCESSING OF SERVICE A
RECEIVE ACCESS OF USER REDIRECTED FROM SERVICE B
S4
EXTRACT ID WHICH IS AUTHENTICATED BY SERVICE B, FROM REDIRECTED ACCESS
S5
EXTRACT SSO MAPPING SETTING RELATED TO EXTRACTED ID
S6
S7
NO
HAS BEEN SETTING FOUND?
YES
ACCESS SERVICE A USING ID OF SERVICE A INDICATED BY FOUND SETTING
S8
END

FIG. 4A

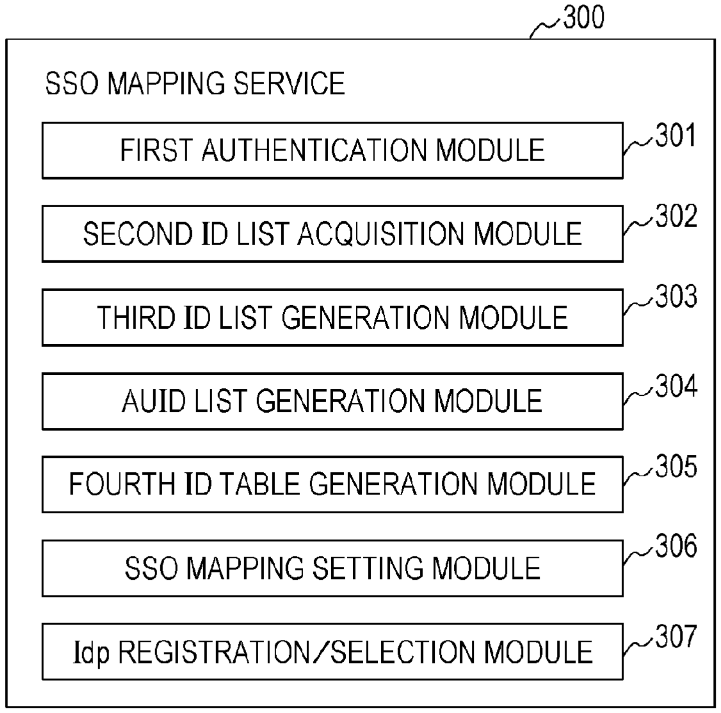

300
SSO MAPPING SERVICE
FIRST AUTHENTICATION MODULE
301
SECOND ID LIST ACQUISITION MODULE
302
THIRD ID LIST GENERATION MODULE
303
AUID LIST GENERATION MODULE
304
FOURTH ID TABLE GENERATION MODULE
305
SSO MAPPING SETTING MODULE
306
Idp REGISTRATION/SELECTION MODULE
307

FIG. 4B

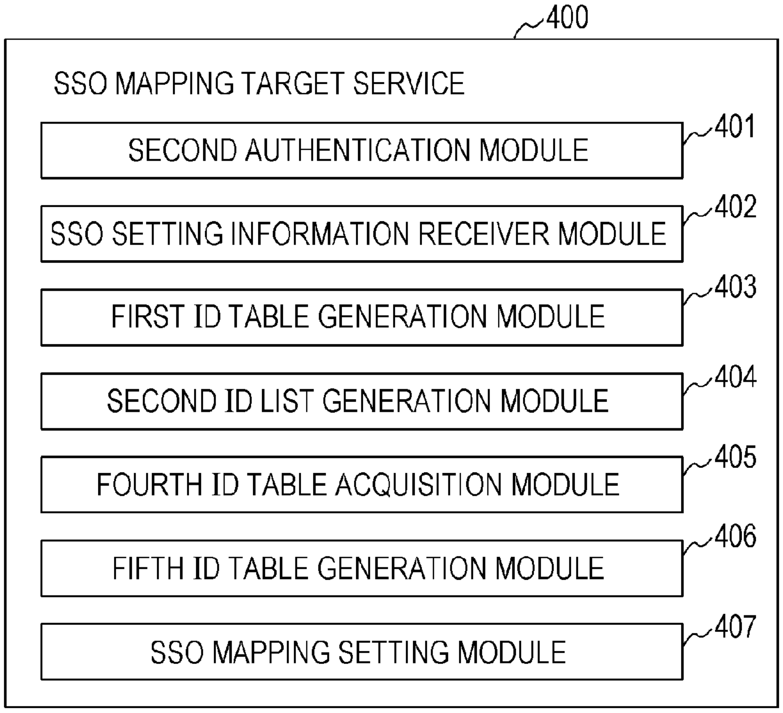
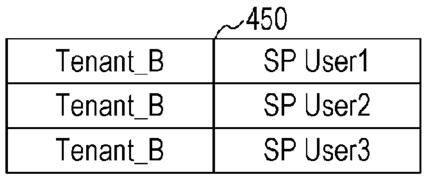
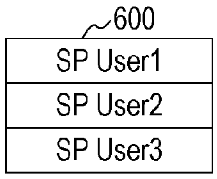

400
SSO MAPPING TARGET SERVICE
SECOND AUTHENTICATION MODULE
401
SSO SETTING INFORMATION RECEIVER MODULE
402
FIRST ID TABLE GENERATION MODULE
403
SECOND ID LIST GENERATION MODULE
404
FOURTH ID TABLE ACQUISITION MODULE
405
FIFTH ID TABLE GENERATION MODULE
406
SSO MAPPING SETTING MODULE
407

FIG. 5A–1



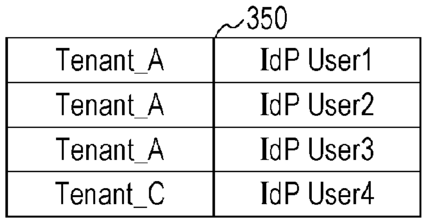
Tenant_B	SP User1
Tenant_B	SP User2
Tenant_B	SP User3

FIG. 5A–2



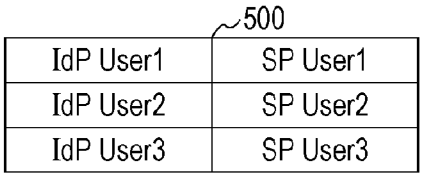
SP User1
SP User2
SP User3

FIG. 5B–1



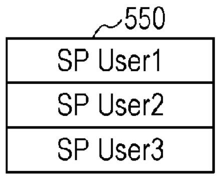
Tenant_A	IdP User1
Tenant_A	IdP User2
Tenant_A	IdP User3
Tenant_C	IdP User4

FIG. 5B–2



IdP User1	SP User1
IdP User2	SP User2
IdP User3	SP User3

FIG. 5B–3



SP User1
SP User2
SP User3

FIG. 6A

601

SP User1	AUID 1
SP User2	AUID 2
SP User3	AUID 3

FIG. 6B

602

IdP User1	AUID 1
IdP User2	AUID 2
IdP User3	AUID 3

FIG. 7A

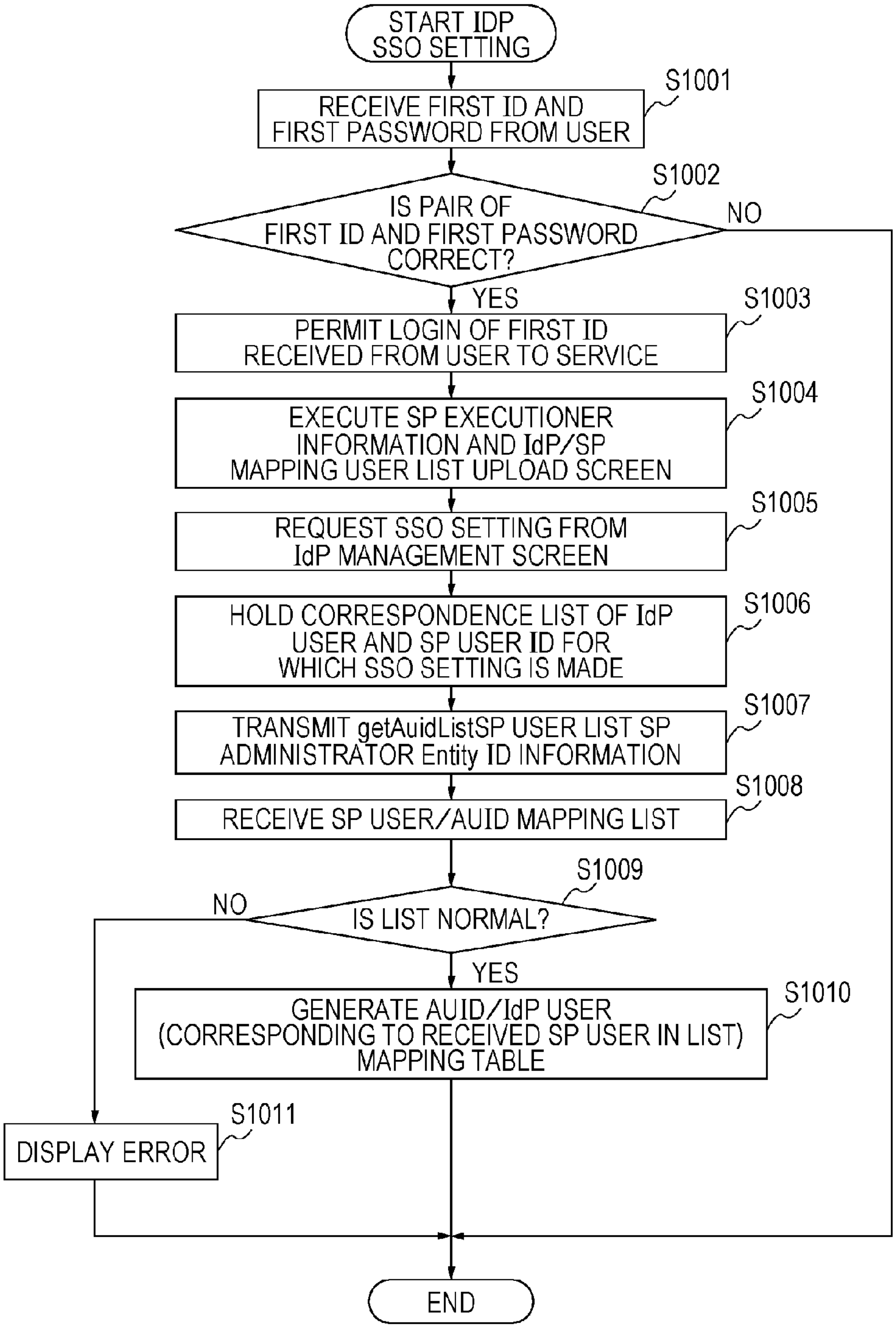

START IDP SSO SETTING
RECEIVE FIRST ID AND FIRST PASSWORD FROM USER
S1001
IS PAIR OF FIRST ID AND FIRST PASSWORD CORRECT?
S1002
NO
YES
PERMIT LOGIN OF FIRST ID RECEIVED FROM USER TO SERVICE
S1003
EXECUTE SP EXECUTIONER INFORMATION AND IdP/SP MAPPING USER LIST UPLOAD SCREEN
S1004
REQUEST SSO SETTING FROM IdP MANAGEMENT SCREEN
S1005
HOLD CORRESPONDENCE LIST OF IdP USER AND SP USER ID FOR WHICH SSO SETTING IS MADE
S1006
TRANSMIT getAuidListSP USER LIST SP ADMINISTRATOR Entity ID INFORMATION
S1007
RECEIVE SP USER/AUID MAPPING LIST
S1008
IS LIST NORMAL?
S1009
NO
YES
GENERATE AUID/IdP USER (CORRESPONDING TO RECEIVED SP USER IN LIST) MAPPING TABLE
S1010
DISPLAY ERROR
S1011
END

FIG. 7B

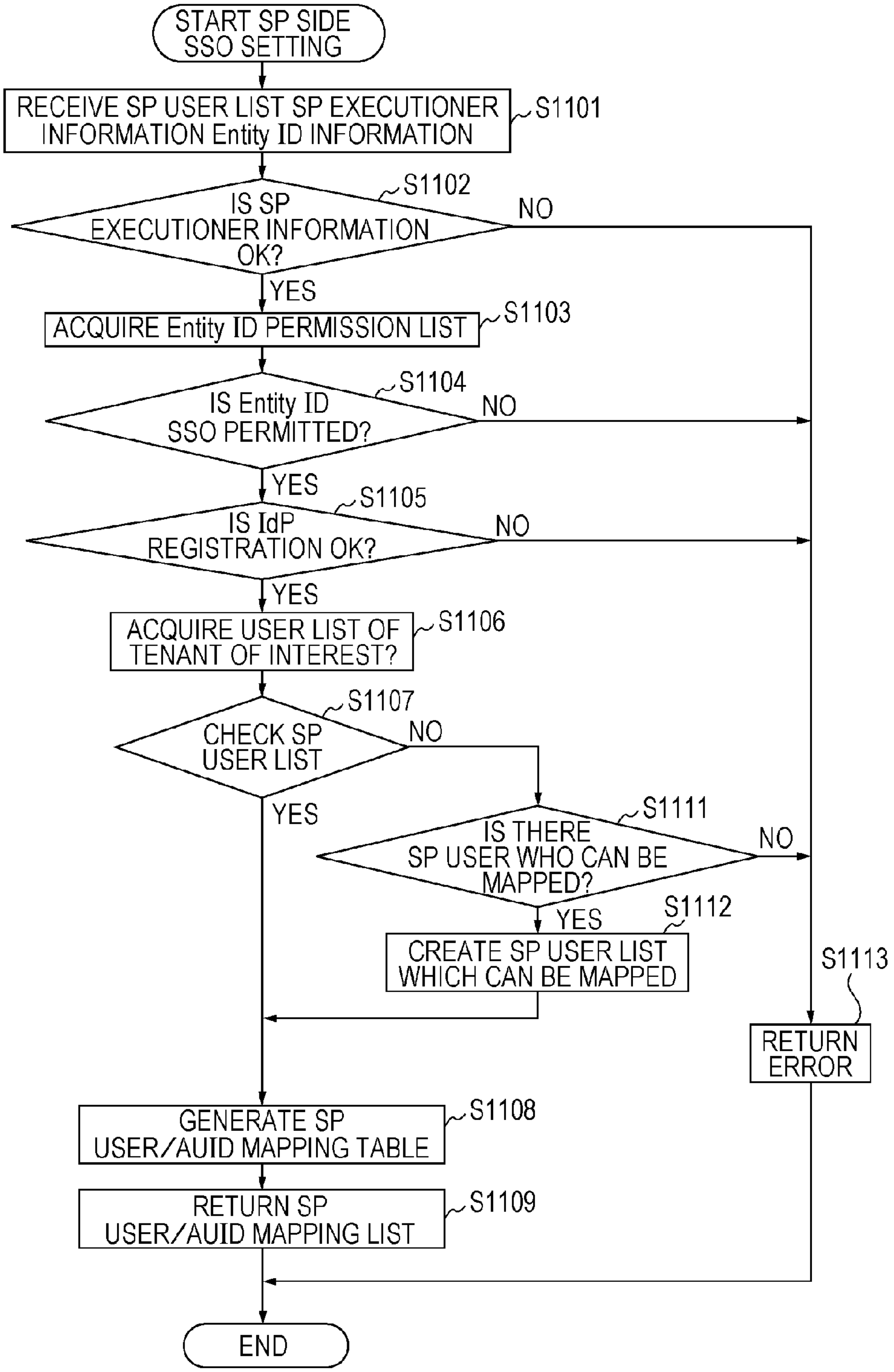

START SP SIDE SSO SETTING
RECEIVE SP USER LIST SP EXECUTIONER INFORMATION Entity ID INFORMATION
S1101
IS SP EXECUTIONER INFORMATION OK?
S1102
NO
YES
ACQUIRE Entity ID PERMISSION LIST
S1103
IS Entity ID SSO PERMITTED?
S1104
NO
YES
IS IdP REGISTRATION OK?
S1105
NO
YES
ACQUIRE USER LIST OF TENANT OF INTEREST?
S1106
CHECK SP USER LIST
S1107
NO
YES
IS THERE SP USER WHO CAN BE MAPPED?
S1111
NO
YES
CREATE SP USER LIST WHICH CAN BE MAPPED
S1112
S1113
RETURN ERROR
GENERATE SP USER/AUID MAPPING TABLE
S1108
RETURN SP USER/AUID MAPPING LIST
S1109
END

FIG. 8A

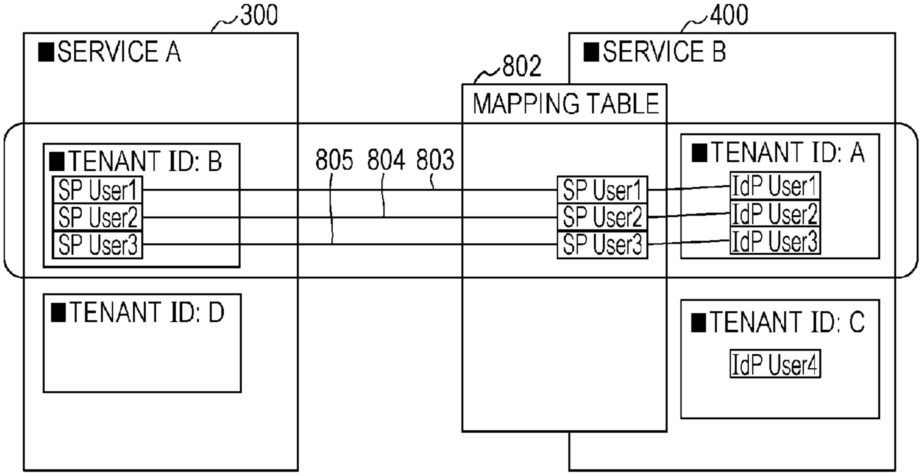

300
■SERVICE A
400
■SERVICE B
802
MAPPING TABLE
■TENANT ID: B
SP User1
SP User2
SP User3
805 804 803
SP User1
SP User2
SP User3
■TENANT ID: A
IdP User1
IdP User2
IdP User3
■TENANT ID: D
■TENANT ID: C
IdP User4

FIG. 8B

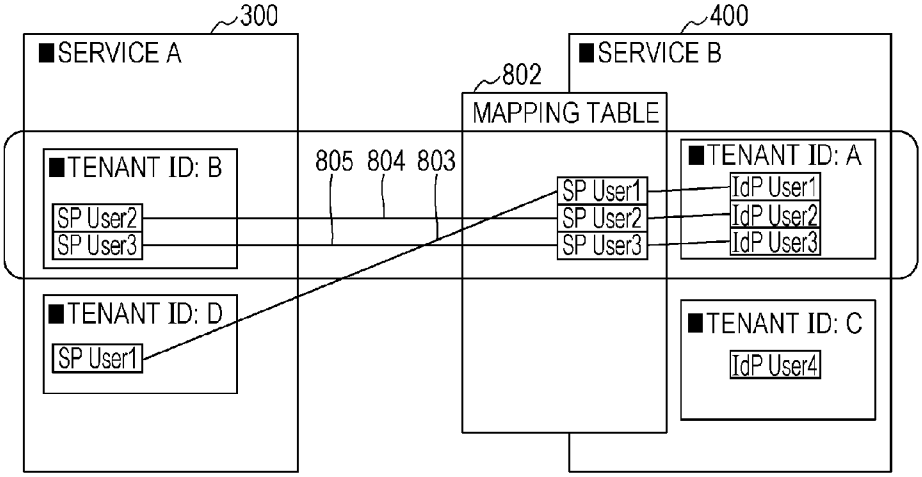

300
■SERVICE A
400
■SERVICE B
802
MAPPING TABLE
■TENANT ID: B
SP User2
SP User3
805 804 803
SP User1
SP User2
SP User3
■TENANT ID: A
IdP User1
IdP User2
IdP User3
■TENANT ID: D
SP User1
■TENANT ID: C
IdP User4

FIG. 8C

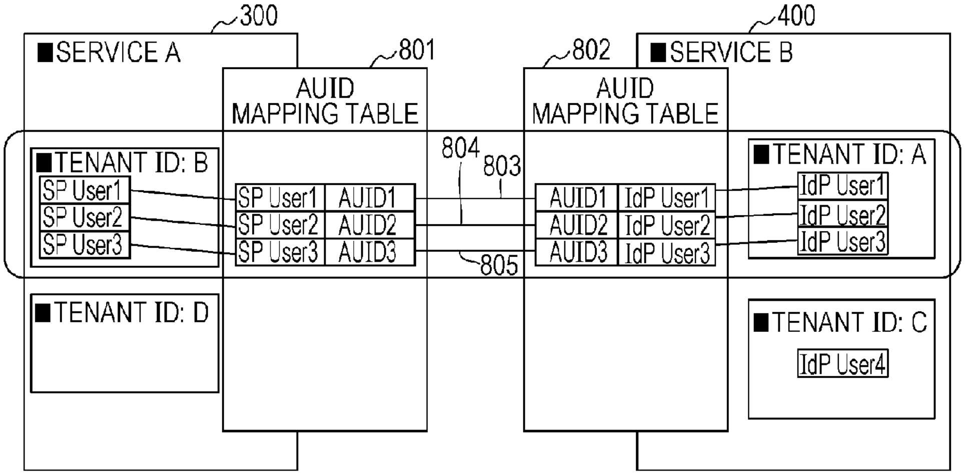

300
■SERVICE A
801
AUID MAPPING TABLE
802
AUID MAPPING TABLE
400
■SERVICE B
■TENANT ID: B
SP User1
SP User2
SP User3
SP User1 AUID1
SP User2 AUID2
SP User3 AUID3
804
803
805
AUID1 IdP User1
AUID2 IdP User2
AUID3 IdP User3
■TENANT ID: A
IdP User1
IdP User2
IdP User3
■TENANT ID: D
■TENANT ID: C
IdP User4

FIG. 8D

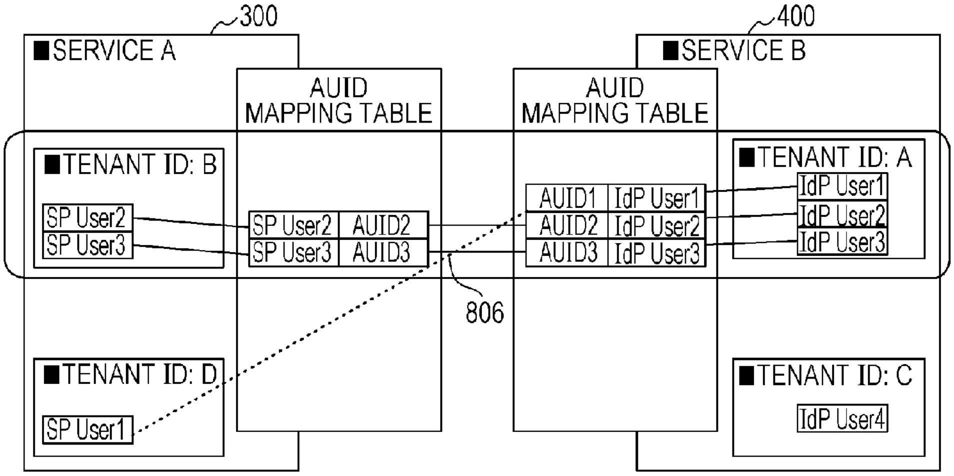

300
■SERVICE A
AUID MAPPING TABLE
AUID MAPPING TABLE
400
■SERVICE B
■TENANT ID: B
SP User2
SP User3
SP User2 AUID2
SP User3 AUID3
AUID1 IdP User1
AUID2 IdP User2
AUID3 IdP User3
■TENANT ID: A
IdP User1
IdP User2
IdP User3
806
■TENANT ID: D
SP User1
■TENANT ID: C
IdP User4

FIG. 9

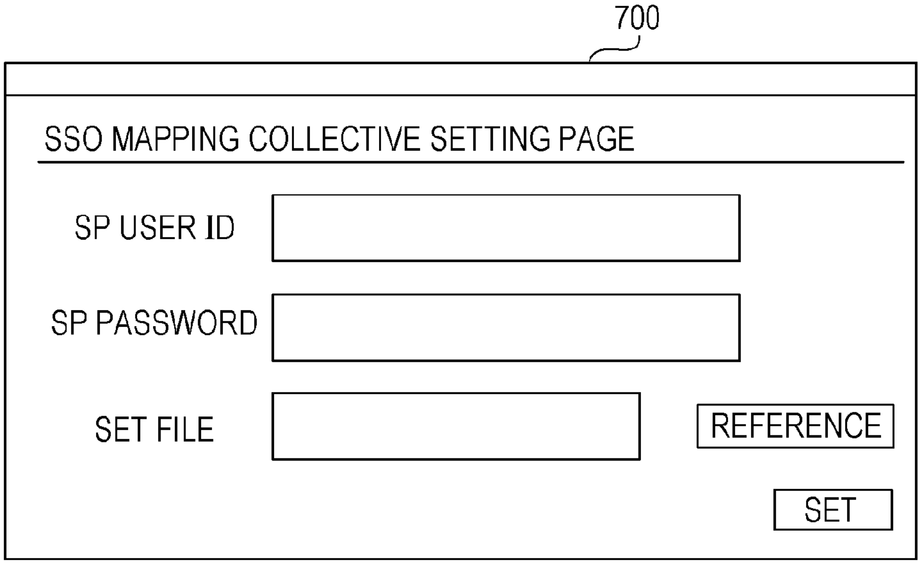
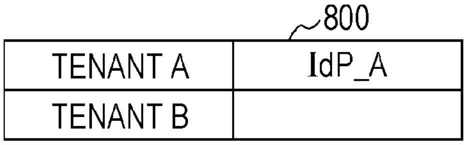
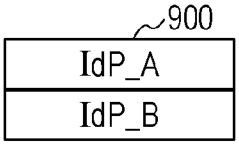


FIG. 10A



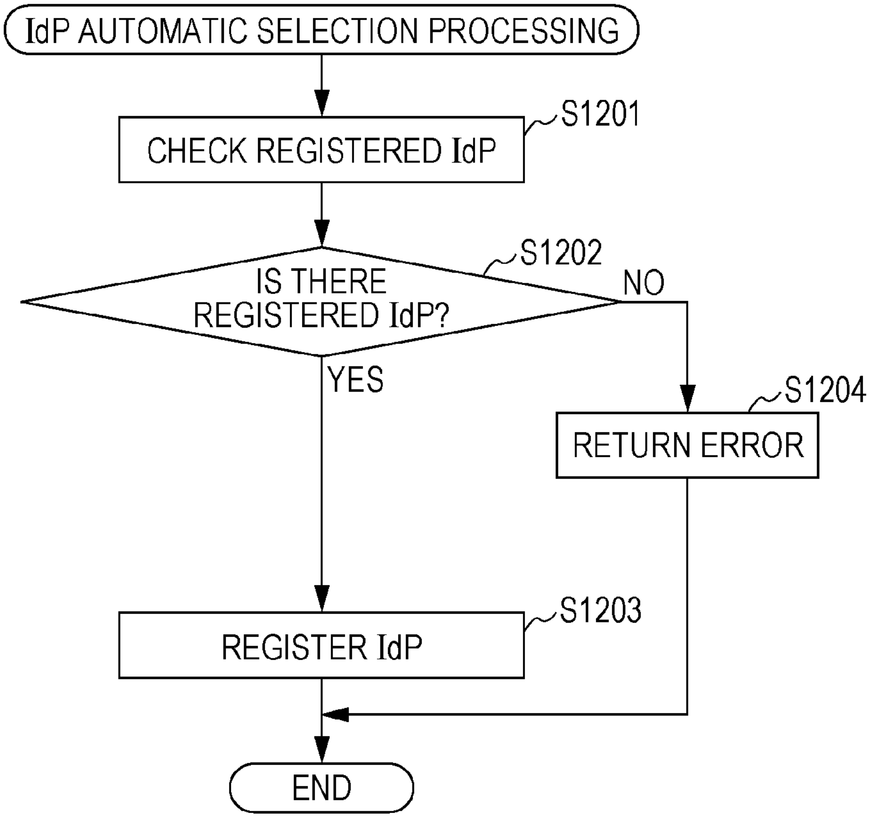
TENANT A	IdP_A
TENANT B	

FIG. 10B



IdP_A
IdP_B

FIG. 11


IdP AUTOMATIC SELECTION PROCESSING
S1201
CHECK REGISTERED IdP
S1202
IS THERE REGISTERED IdP?
NO
YES
S1204
RETURN ERROR
S1203
REGISTER IdP
END

SYSTEM, CONTROL METHOD, AND STORAGE MEDIUM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a setting method of single sign-on mapping which realizes single sign-on between services which support multiple tenants.

2. Description of the Related Art

Conventionally, a mechanism of single sign-on (referred to as "SSO" below) based on a Security Assertion Markup Language (referred to as "SAML" below) is known as a technique of cooperating user authentication between a plurality of servers under different domains. A system which realizes the SAML includes a server group (Identity Provider which is referred to as an "IdP" below) which provides an authenticating function. Further, the system which realizes the SAML also includes a server group (Service Provider which is referred to as an "SP" below) which is configured with at least one or more servers which provide a function by trusting an authentication result of the IdP. A user who utilizes the SSO based on the SAML registers authentication information such as user IDs of respective domains of the above IdP and SP.

For example, the user is authenticated by an ID provider based on user authentication information such as a user ID and a password managed by the IdP.

When the user is provided with a function of the SP, the user needs to access the IdP and be authenticated. For example, the user is authenticated by the IdP using the user ID and the password managed by the IdP. Further, the IdP issues to the authenticated user a SAML assertion which is a certificate of authentication for the SP. The SP authenticates the user by verifying whether this SAML assertion is issued by the trusted IdP. In this case, the user can enjoy services provided by the server group which cooperates with the SP, without inputting authentication information managed by the SP.

As described above, SSO based on the SAML depends on a trust relationship between the IdP and the SP. Hence, before SSO is realized, an ID provider and a service provider need to have a trust relationship in advance. This trust relationship is established by trading meta data which describes which function of a plurality of functions of the SAML performs SSO, and an electronic certificate which certifies that an assertion is issued by an ID provider. Specific contents of the meta data and a technique related to establishment of this trust relationship are defined by SAML V2.0 which is a standard technology. Meta data and Information such as an electronic certificate for verifying an assertion are referred to as "prior information". The service provider performs verification using the prior information when verifying whether the assertion satisfies the requirements. Further, the prior information is generally data issued by an ID provider.

In addition, when the user accesses the SP by way of SSO, a user ID for the SP is not passed to the SP as described above. More specifically, when the user first accesses the SP, this access is redirected to the IdP. Further, the user accesses the SP by using a SAML assertion issued when logging in the IdP. Meanwhile, an SP ID for accessing the SP by using an IdP ID included in the SAML assertion or information corresponding to the IdP ID is specified. To specify the SP ID from the IdP ID included in this SAML assertion or information corresponding to the IdP ID, a mapping table which indicates a correspondence relationship between the IdP ID or information corresponding to the IdP ID and the SP ID is required. In addition, creating this mapping table is referred to as "single

sign-on mapping" (referred to as "SSO mapping" below). To realize SSO, it is necessary to generate an adequate mapping table by SSO mapping.

Further, Japanese Patent Application Laid-Open No. 2004-234329 discloses an SSO technique of creating an SP ID in advance and keeping the ID without allocating the ID to a user. Further, Japanese Patent Application Laid-Open No. 2004-234329 discloses an SSO mapping server which, when succeeding authentication by passing an ID and a password to an IdP, allocates an account of the SP to the IdP ID. This system realizes SSO mapping if validity of a user can be checked by the IdP.

However, a conventional method has the following problem. That is, conventionally, it is not taken into account a case where a user ID is deleted after SSO mapping is performed once, and the same user ID is registered.

SUMMARY OF THE INVENTION

To solve the above problem, the present invention is a system which manages a plurality of pieces of user information, and which has: a receiver unit which receives user information from another system; and a transmitting unit which transmits a table which associates the received user information and unique identification information of the plurality of pieces of user information, and, when the other system succeeds user authentication, the system provides a function of the system without performing the user authentication in the system based on the unique identification information.

Further features of the present invention will become apparent from the following description of exemplary embodiments (with reference to the attached drawings).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view of a network configuration.

FIG. **2** is a block diagram of a PC according to an embodiment of the present invention.

FIG. **3**A-**3**B is a general login flow which uses an SSO mapping setting.

FIG. **4**A-**4**B is a module block diagram according to the embodiment of the present invention.

FIG. **5**A-**1**-**5**A-**2** and FIG. **5**B-**1**-**5**B-**3** illustrates an example of a tenant specific user list data according to the embodiment of the present invention.

FIG. **6**A-**6**B illustrates an example of first and second ID lists and SSO mapping setting information according to the embodiment of the present invention.

FIG. **7**A-**7**B is a setting flow of SSO mapping according to the embodiment of the present invention.

FIG. **8**A-**8**D is a view of a setting status of SSO mapping according to the embodiment of the present invention.

FIG. **9** illustrates an example of a screen of an SSO mapping setting according to the embodiment of the present invention.

FIG. **10**A-**10**B is a view of a correspondence relationship for realizing automatic registration of IdPs.

FIG. **11** is a flow for realizing automatic registration of IdPs.

DESCRIPTION OF THE EMBODIMENTS

An object of the present invention is to make an SSO mapping setting of adequate IDs between services for which authentication needs to be cooperated. In addition, single sign-on according to the present invention enables to provide a system function without authenticating a user at a system when another system succeeds authentication of the user.

First, a current embodiment and a current problem will be described with reference to FIGS. **8**A and **8**B, and it will be described that the current problem will be solved using FIGS. **8**C and **8**D based on a specific example.

FIG. **8**A is a view illustrating a current SSO mapping setting status.

A service B **400** (IdP) which is an SSO mapping target service includes a tenant A and a tenant C, and the tenant A includes IdP User 1 to 3 as user IDs. Further, the tenant C includes IdP User 4 as a user ID.

A service A **300** (SP) which is an SSO mapping service includes a tenant B and a tenant D, and the tenant B includes SP User 1 to 3 as user IDs. Further, the tenant D does not include any user ID.

Meanwhile, FIG. **8**B illustrates a status in which SP User 1 of the tenant ID B of the SSO mapping service A **300** is deleted from the status in FIG. **8**A and the same user SP User 1 is created for the tenant ID D without with reference to processing according to the present invention.

The status in FIG. **8**B is a status in which IdP User 1 can perform SSO to the tenant ID D. That is, in the status in FIG. **8**A, there is a problem that, even though it is designated that IdP User 1 uses the tenant ID B, the IdP User 1 accesses a tenant different from the original designation by way of SSO.

Next, it will be described that the above problem will be solved by using an AUID with reference to FIGS. **8**C to **8**D.

FIG. **8**(*c*) is a view illustrating an SSO mapping setting status according to an embodiment of the present invention.

A service B **400** (IdP) which is an SSO mapping target service includes a tenant A and a tenant C, and the tenant A includes IdP User 1 to 3 as user IDs. Further, the tenant C includes IdP User 4 as a user ID.

A service A **300** (SP) which is an SSO mapping service includes a tenant B and a tenant D, and the tenant B includes SP User 1 to 3 as user IDs. Further, the tenant D does not include any user ID.

Here, by performing a flow in FIG. **7**A-**7**B, an SSO mapping setting is executed between IdP User 1 and SP User 1. Further, the SSO mapping setting is also executed between IdP User 2 and SP User 2 and between IdP User 3 and SP User 3. According to this mapping, a fourth ID table and a fifth ID table are set to an AUID mapping table **801** and an AUID mapping table **802**, respectively, so that an adequate SSO mapping setting is made.

FIG. **8**D is a view illustrating an SSO mapping setting status according to an embodiment of the present invention when the status in FIG. **8**C changes.

SP User 1 of the tenant ID B of the SSO mapping service A **300** is deleted from the status in FIG. **8**C, and the same user SP User 1 is created from the tenant ID D. That is, the same operation as that in FIG. **8**B was performed.

In case of the present embodiment, the mapping state is also deleted following deletion of the user ID, and then SP User 1 and AUID 1 are deleted from the AUID mapping table **801** of the SSO mapping service A **300**. Hence, even if, for example, the same user SP User 1 is recreated for the tenant ID D, there is no relationship like the SSO mapping **806**. That is, it is possible to prevent occurrence of the problem described with reference to FIGS. **8**A and **8**B. Hence, when SSO mapping is set according to the flow illustrated in FIG. **7**A-**7**B, the SSO mapping service A **300** deletes a user ID. Further, even when an operation which is directed to recreating the same user ID for another tenant and which is not noticed by an SSO mapping target service B side is executed, it is possible to prevent unintended SSO.

Hereinafter, the best mode for implementing the present invention will be described with reference to the drawings.

An authority transfer system according to the present embodiment is realized on a network employing a configuration illustrated in FIG. **1**.

According to the present invention, the world wide web (WWW) system is constructed on a wide area network **100** (WAN **100**). A local area network **101** (LAN **101**) connects each component.

A user operates a client PC **200**, and the service A **300** and the service B **400** provides services (functions) when the user is authenticated. In addition, the services (functions) provided by the service A and the service B are a printing function and a business form function. The business form function is a function of creating a business form by executing overlay processing by holding a template at the SP and using content data received from an IdP and a template held at the SP.

Further, the client PC **200**, the service A **300** and the service B **400** are connected through the WAN network **100** and the LAN **101**. In addition, the client PC **200** and respective services may be configured on individual LANs or may be configured on a single LAN. Further, the client PC **200** and respective services may be configured on a single PC. The service A **300** and the service B **400** operate on a server group A **300** and a server group B **400**, respectively. The server group A and the server group B are configured by authentication servers and servers which provide services. The server groups A and B are configured by, for example, authentication servers and servers which provide services. The authentication server and the server which provides a service may be configured by one server or may be configured by a plurality of servers. In addition, in this description, although the server group A is referred to as an "SP", and the server group B is referred to as an "IdP", these may be reversed. The service B **400** first receives login of a user. Next, when receiving an SSO mapping setting request from a user, the service B generates a first ID table. In addition, the SSO mapping setting request is issued when the user pushes a setting button in FIG. **9** described below.

The first ID table is configured by a list of tuples of user IDs of the service A **300** as an SSO mapping target and user IDs of the service B **400** associated with the user IDs of the service A **300**. In addition, at a stage at which a user who uses the service B **400** (IdP) requests use of the service A **300** (SP), the service B **400** (IdP) can acquire the user ID of the service A **300**. This is an example, and a user ID of an SP only needs to be acquired before the first ID table is created.

In addition, FIG. **5**B-**2** described below illustrates an example of the first ID table. Further, the service B **400** generates a second ID list as an SSO mapping setting request. The second ID list is configured by a user ID list of the service A **300** which is an SSO mapping setting request target in the first ID table. In addition, FIG. **5**B-**3** described below illustrates an example of the second ID list. The service B **400** transmits to the service A **300** the second ID list and information such as SSO mapping executioner information of the service A **300** and entity information of the service B **400** in the service A **300** required for SSO mapping. In addition, the SSO mapping executioner information of the service A **300** is information designated by the user ID of the SP in FIG. **9** described below.

Here, the entity information is defined according to a SAML protocol, and, for the SP, the IdP is identified according to an ID which is referred to as an "entity ID". This entity ID is described in meta data which was traded in advance. As server groups which provide an authentication function, some IdPs are systems which have single entity IDs, and some IdPs are systems which can have a plurality of entity IDs. The service B **400** as an IdP has a single entity ID, and can acquire the entity ID as entity information from an entity ID acquisition means. Naturally, the service B may have a plurality of entity IDs.

Meanwhile, the service A **300** receives from the service B **400** the second ID list which is the user ID list of the service A **300** which is an SSO mapping setting request target. In this case, the service A **300** receives the SSO mapping executioner information of the service A **300** and the entity information of the service B **400** in the service A **300**, together with the second ID list. The service A **300** checks a registered entity from the entity information of the service B **400** among the received information, determines an SSO mapping executioner from the SSO mapping executioner information of the service A **300** and acquires a third user ID list which the SSO mapping executioner can acquire. The service A **300** checks that each user in the acquired second ID list is included in the third user ID list. The service A **300** dynamically generates an AUID (Account Unique Identifier) list associated with each user in the second ID list. The AUID is a unique universally unique identifier (UUID). The service A **300** generates a fourth ID table. The fourth ID table is configured by tuples of the second ID list and a list of the AUIDs associated with the respective user IDs in the second ID list. The service A **300** returns the fourth ID table in response to the SSO mapping setting request of the service B **400**. The service A **300** performs SSO mapping using the fourth ID table.

The service B **400** receives the fourth ID table transmitted from the service A **300**. The service B **400** compares the received fourth ID table and the stored first ID table, and generates a fifth ID table. The fifth ID table is configured by a list of tuples of AUIDs associated with the respective IDs in the second ID list transmitted to the service A **300** in response to the SSO mapping setting request. The service A **300** performs SSO mapping using the fifth ID table.

The service A **300** and the service B **400** each operate on a server computer described below.

Hereinafter, a relationship between the IdP and the SP will be described.

For example, the SAML is realized by HTTP, and an end point is defined according to a URL. The end point refers to an address of an IdP. Further, while an electronic certificate which differs from one Entity ID to another is required to sign an assertion, the electronic certificate is issued being liked to a host name. As a result, the IdP has a host name which differs from one Entity ID to another in order to have a plurality of Entity IDs. In addition, each host name enables host name solution, and needs to be associated with an IP address as a result of host name solution. When the IdP dynamically adds an Entity ID in response to a user's request, the IdP needs to have a DNS server and performs an operation of registering a new host name and an IP address in the DNS server following addition of the Entity ID. Hence, the IdP has a difficulty in having a plurality of Entity IDs if the IdP does not have a relatively large scale.

In a case where a service is provided to a third party such as an application service provider, user friendliness may be improved by restricting the third party's access to a specific URL. In such a case, the URL is single and the Entity ID is single.

As described above, it varies depending on a configuration of the IdP whether the number of Entity IDs is single or plural. As in the present embodiment, the IdP has only a single entity ID.

FIG. **2** illustrates a configuration of the client PC **200** according to the present embodiment. Further, the configuration of a server computer which provides the service A **300** and the service B **400** is also the same. In addition, a hardware block diagram illustrated in FIG. **2** corresponds to a hardware block diagram of a general information processing apparatus, and a hardware configuration of a general information processing apparatus is applicable to the client PC **200** and the server computer according to the present embodiment.

In FIG. **2**, a CPU **201** executes programs such as an OS and an application which are stored in a program ROM of a ROM **203** or loaded to a RAM **202** from a hard disk **211**. Hereinafter, the term OS is an abbreviation of an operating system which operates on a computer, and the operating system will be referred to as an "OS" below. Processing in each flowchart described below can be realized by executing this program. The RAM **202** functions as a main memory and a work area of the CPU **201**. A keyboard controller (KBC) **205** controls a key input from a keyboard (KB) **209** and a pointing device which is not illustrated. A CRT controller (CRTC) **206** controls display of a CRT display **210**. A disk controller (DKC) **207** controls a data access to a hard disk (HD) **211** or a floppy (registered trademark) disk (FD) which stores various items of data. An NC **212** is connected to the network, and executes communication control processing with other devices connected with the network.

In addition, a main entity for execution on the hardware is the CPU **201** in the following entire description unless otherwise mentioned, and a main entity on software is an application program installed in the hard disk (HD) **211**. For example, each step in the flowcharts according to the present invention is realized when the CPU reads and executes a program related to the flowchart.

FIG. **3**A-**3**B is a login flow of general SSO which uses an SSO mapping setting. Hereinafter, an example will be described where the service B **400** operates as an IdP and the service A **300** operates as an SP. In addition, the service A **300** may be an IdP, and the service B **400** may be an SP.

In a case where the service B **400** is an IdP, when authenticated by the service B **400**, the user can enjoy a service provided by the service A **300**.

In the following example, a flow will be described in the case where a user is first authenticated by the service B **400**, and then enjoys the service of the service A **300** by way of SSO. In addition, the flow may go in such a manner that the user accesses the service A **300**, then is redirected to the service B **400**, is authenticated by the service B **400** and then enjoys the service of service A **300**.

FIG. **3**A is an SSO login flow on an IdP side, wherein the service B **400** is an IdP.

In step S**1**, the service B **400** receives a user authentication request from a user who desires to enjoy the service of the service A **300**. Here, the service B **400** receives an ID and a password of the service B from the user to be authenticated by the service B.

In step S**2**, the service B **400** checks whether a combination of the ID and the password of the service B received from the user in step S**1** is correct (executes user authentication). The service B **400** holds adequate combinations of the IDs and passwords, and realizes processing in step S**1** depending on whether the combination received in step S**1** is held as an adequate combination. When the combination is correct, the flowchart transitions to step S**3**. Further, when the combination is not correct, the flowchart is finished.

In step S**3**, the service B **400** executes user authentication, and redirects an access from the user to the service A **300**. Further, in this case, the redirected access and an ID of the user authenticated by the service B **400** (or information corresponding to the ID of the user authenticated by the service

B) are transmitted. When the service B **400** finishes redirection, the flowchart is finished. In addition, processing in step S**3** is executed when the user selects to use a service of the SP using a UI on the IdP side after it is decided in step S**2** that a pair of the ID and the password is decided to be correct.

FIG. **3**B is a general SSO login flow on an SP side, wherein the service A **300** is an SP.

In step S**4**, the service A **300** receives a user's access redirected from the service B **400**.

In step S**5**, the service A **300** extracts the ID of the user authenticated by the service B.

In step S**6**, the service A **300** extracts a mapping table which is related to the user ID extracted in step S**5** and which is generated by SSO mapping.

In step S**7**, the service A **300** decides whether an SSO mapping setting is found in step S**6**. If found, the flowchart transitions to step S**8**, and, if not, the flowchart is finished.

In step S**8**, the service A **300** executes user authentication using the ID of the service A indicated by the SSO mapping setting found in step S**6**. Further, the service A **300** permits the access received in step S**4** and provides the service, and then the flowchart is finished.

As described above, if SSO mapping is set, the user can enjoy the service provided by the service A **300** by passing the ID and the password of the service B **400** only to the service B **400**.

FIG. **4**A-**4**B is a module block diagram according to the embodiment of the present invention. In addition, although the service A **300** is an SSO mapping service and the service B **400** is an SSO mapping target service, a correspondence relationship between services is not limited to the above relationship. In addition, as described above, each module illustrated in FIG. **4**A-**4**B is stored in the HDD, and is realized by being loaded to the memory and executed by the CPU.

FIG. **4**A is a module block diagram of the SSO mapping service **300** according to the embodiment of the present invention. In addition, the SP has the modules of the SSO mapping service **300**. The SSO mapping service **300** has a first authentication module **301**, a second ID list acquisition module **302**, a third ID list generation module **303**, an AUID list generation module **304**, a fourth ID table generation module **305**, an SSO mapping setting module **306** and an IdP registration/selection module **307**. The SSO mapping setting module **306** has an API which returns a fourth ID table in response to an SSO mapping ID table generation request for generating a mapping table required to realize SSO. The SSO mapping setting module **306** receives the second ID list from the SSO mapping target service **400**. Further, a third ID list is generated as a list of IDs which can be acquired by the authority of the user authenticated by the first authentication module **301** using the third ID list generation module **303**. The SSO mapping target user ID list included in the second ID list in the third ID list is generated. An SSO mapping setting file **500** which is a fourth ID table associated with AUIDs dynamically generated for respective IDs of the SSO mapping target user ID list is generated, and the SSO mapping service makes the SSO mapping setting and returns the fourth ID table. The IdP registration/selection module **307** registers the SSO mapping target service **400** as an IdP of an SAML protocol. Further, in response to the SSO mapping setting request, the IdP registration/selection module **307** provides a function of enabling selection of currently effective IdPs, to a user who uses a plurality of IdPs as SP side users.

FIG. **4**B is a module block diagram of the SSO mapping target service **400** according to the embodiment of the present invention. In addition, the IdP has modules of the SSO mapping target service. The SSO mapping target service **400** has a second authentication module **401**, an SSO setting information receiver module **402**, a first ID table generation module **403**, a second ID list generation module **404**, a fourth ID table acquisition module **405**, a fifth ID table generation module **406** and an SSO mapping setting module **407**. The SSO mapping setting module **407** issues an SSO mapping ID table generation request for SSO mapping. When acquiring the SSO mapping ID table for SSO mapping from the SSO mapping service **300**, the SSO mapping setting module **407** generates the fifth ID table and makes the SSO mapping setting.

FIG. **5**A-**1**-**5**A-**2** and FIG. **5**B-**1**-**5**B-**3** illustrates an example of user list data which is an SSO mapping target according to the embodiment of the present invention. **450** in FIG. **5**A-**1** is an example of tenant- (group-) specific user list data managed by the SSO mapping service, and **350** in FIG. **5**B-**1** is an example of tenant-specific user list data managed by the SSO mapping target service. Here, the SSO mapping target service **400** includes two tenants of a Tenant A and a Tenant C. Further, a data is an example in the case where users IdP User 1 to 3 belongs to the Tenant A and a user IdP User 4 belongs to the Tenant C. Furthermore, data is an example in the case where the SSO mapping service **300** includes one tenant of the Tenant B, and users SP User 1 to 3 belongs to the Tenant B. Still further, **500** in FIG. **5**B-**2** illustrates an example of the first ID table generated by the first ID table generation module **403** in FIG. **4**B. **550** in FIG. **5**B-**3** is an example of the second ID list generated by the second ID list generation module **404** in FIG. **4**B. Further, **600** in FIG. **5**A-**2** is an example of the third ID list generated by the third ID list generation module **303** in FIG. **4**A.

FIG. **6**A-**6**B illustrates an example of the fourth and fifth ID tables according to the embodiment of the present invention. A fifth ID table **602** is an example of the fifth ID table generated by the fifth ID table generation module **406** described with reference to FIG. **4**B. A fourth ID table **601** is an example of the fourth ID table generated by the fourth ID table generation module **305** described with reference to FIG. **4**A.

FIG. **7**A-**7**B is a flowchart of an SSO mapping setting according to the embodiment of the present invention. In addition, the SSO mapping setting refers to generation of A and B in FIG. **6**A-**6**B. FIG. **7**A illustrates a flowchart of IdP side SSO mapping, that is, the SSO mapping target service **400**, and FIG. **7**B illustrates a flowchart of SP side SSO mapping, that is, the SSO mapping service **300**.

FIG. **7**A is a flowchart illustrating a setting flow of SSO mapping of the SSO mapping target service **400** according to the embodiment of the present invention. This flowchart is started when the user who wants to create a mapping table of SSO mapping accesses the SSO mapping target service **400**.

In step S**1001**, the second authentication module **401** receives a first ID and a first password for user authentication by the SSO mapping target service **400** from the user who accesses the SSO mapping target service **400**. That is, the second authentication module **401** receives the ID and the password for the IdP.

In step S**1002**, the second authentication module **401** decides whether a combination of the first ID and the first password received in step S**1001** is correct. If the combination is correct, the flowchart transitions to step S**1003**. Further, if the combination is not correct, the user's access is denied, and this flowchart is finished.

In step S**1003**, the second authentication module **401** permits login of the first ID received from the user, to the SSO mapping target service **400**. In addition, the user ID is IdP User 1.

In step S**1004**, the SSO setting information receiver module **402** receives SSO mapping setting information from the user. The SSO mapping setting information is configured with an SP side user ID, a password associated with the SP side user ID and an SSO mapping information file. The SSO mapping information file is an information file describing a user ID which is a target of SSO mapping desired by the user, and is provided in a CSV, JSON or XML format. In addition, a screen which allows the user to input the SSO mapping setting information is as illustrated in, for example, FIG. **9**, and, when the setting button is pushed, the SSO mapping setting information is uploaded. Here, a case will be considered where SSO mapping setting information **500** describes information for which the SSO mapping setting is made for each combination of IdP User 1 and SP User 1, IdP User 2 and SP User 2 and IdP User 3 and SP User 3. In the case of the present embodiment, the information is a CSV file and is the information as described below:

IdP User 1, SP User 1;
IdP User 2, SP User 2; and
IdP User 3, SP User 3.

The SSO mapping setting information in which this information is described is uploaded as illustrated in FIG. **9**.

In step S**1005**, the SSO setting information receiver module **402** generates the first ID table **500** using the first ID table generation module **403** based on the SSO mapping setting information received in step S**1004**. Further, the SSO setting information receiver module **402** generates an SSO setting request ID list **550** (second ID list) which is an argument of an SSO setting request API with respect to the service **300** described below based on the first ID table **500**. Furthermore, the SSO setting information receiver module **402** acquires an entity ID of the SSO mapping service B **400**. In some cases, the entity ID is simply referred to as “specifying information”.

In step S**1006**, the SSO setting information receiver module **402** temporarily stores the first ID table **500** generated in step S**1005**. The first ID table **500** stored here is used by the SSO mapping setting module **407** described below to generate a fifth ID table **602**.

In step S**1007**, the SSO setting information receiver module **402** transmits the SSO mapping setting request to the service A **300** using the information collected in step S**1004** and step S**1005** as arguments. The information to be transmitted together with the SSO mapping setting request is SP executioner information (an SP user ID and an SP password), an SSO setting request ID list **550** and the entity ID of the service B **400**.

Here, the SSO mapping target service **400** waits for the SSO mapping service **300** to respond to the SSO mapping setting request, that is, a fourth ID table generation request.

In step S**1008**, the SSO setting information receiver module **402** receives the fourth ID table **601** according to a processing result of the SSO mapping service **300** described below with reference to FIG. **7**B.

In step S**1009**, the SSO setting information receiver module **402** makes decision on the received fourth ID table. In this decision, whether the SP users, SP User 1 to 3, included in the fourth ID table received in step S**1008** are included in the first ID table **500** stored in step S**1006**. If the user of the IdP is not correct as a result of decision, processing is stopped, an error message is displayed in step S**1011** (not illustrated), and then this flowchart is finished. If the decision result is normal, the flowchart transitions to next step S**1010**. For example, when SP User 1 and SP User 4 are included in the fourth ID table, processing is advanced for the SP User 1. However, SP User 4 is not included in the first ID table **500**. Therefore, an error occurs.

In step S**1010**, the SSO setting information receiver module **402** generates a fifth ID table using the fifth ID table module **406**. The fifth ID table is generated using the first ID table **500** stored in step S**1006** and the fourth ID table **601** received in step S**1008**. The fifth ID table generation module **406** generates a fourth ID table **601** using the fourth ID table **601** received in step S**1008** and the first ID table **500** stored in step S**1006**. More specifically, IdP User 1, IdP User 2 and IdP User 3 in the first ID table **500** associated with SP User 1, SP User 2 and SP User 3 in the fourth ID table **601** are extracted. Further, extracted IdP User 1, IdP User 2 and IdP User 3 are associated with AUID 1, AUID 2 and AUID 3 in the fourth ID table **601**. According to the above processing, the SSO setting information receiver module **402** generates the fifth ID table **602**, and makes the SSO mapping setting.

This SSO mapping setting is finished, and this flowchart is finished. In addition, in this SSO mapping setting, settings of AUIDs are also deleted following deletion or movement of the user ID. More specifically, when there are settings of IdP User 1 and AUID 1 on the AUID mapping table, the settings of IdP User 1 and AUID 1 are also deleted from the AUID mapping table following deletion of the IdP User 1.

As a result, even when, for example, SSO mapping is performed once, then the user ID is deleted and the same user ID is registered again, an AUID different from the user ID before deletion is issued to the re-registered user ID. Consequently, it is possible to realize adequate SSO.

Although the description has been made for the case where the processing in FIG. **7**A is processed by one server, the processing in FIG. **7**A may be realized using a system configured with a plurality of servers. When the system configured with a plurality of servers realizes the processing in FIG. **7**A, each server has each module in FIG. **4**A.

FIG. **7**B is a flowchart according to the embodiment of the present invention in which the SSO mapping service **300** generates the fourth ID table. This flowchart starts when the SSO mapping service **300** receives a fourth ID list generation request from the SSO mapping target service **400** in step S**1101**. The fourth ID table generation request includes the SP user ID described in step S**1007**, the SP password, an SSO setting request ID list (second ID list) **550** and the entity ID of the service B **400**.

In step S**1102**, the first authentication module **301** decides whether a combination of the SP user ID and the SP password included in the fourth ID list generation request is correct. When it is decided that the combination is correct, the flowchart transitions to step S**1103**, and, when it is decided that the combination is not correct, an error is returned in step S**1114** without returning the fourth ID table to the SSO mapping target service **400**, and this flowchart is finished. In addition, a tenant ID is specified by using these SP user ID and SP password.

In step S**1103**, the first authentication module acquires an entity ID list which has been already registered, by using the SSO mapping setting module **306** to determine the entity ID included in the fourth ID list generation request. SSO of the entity IDs registered in this entity ID list is permitted by the SSO mapping service **300**. That is, it is set for each entity ID in the entity ID list whether SSO is permitted.

In step S**1104**, the first authentication module decides whether the entity ID included in the fourth ID list generation request is included in the entity ID list acquired in step S**1103**. When it is determined that the entity ID is included, the flowchart transitions to step S**1105** and, when it is determined the entity ID is not included, an error is returned in step S**1114** without returning the fourth ID table to the SSO mapping target service **400**, and this flowchart is finished.

In step S1105, the IdP registration/selection module 307 checks an IdP registration status of the SP user included in the fourth ID list generation request. More specifically, the SP has a list in which IdPs are registered for respective tenant IDs. The SP refers to this list in step S1105, and decides whether the IdP is registered in a current target tenant ID. When the IdP is registered, processing in step S1105 is determined as Yes, and, when the IdP is not registered, the processing in step S1105 is determined as No.

In step S1106, the third ID list generation module generates a third ID list which indicates a list of IDs which can be acquired by an authority of a user (that is, SP executioner information) authenticated by the first authentication module 301. For example, FIG. 5A-2 of this application corresponds to the third ID list, and current SP executioner information indicates that information about the SP User 1 to 3 is acquired. Details will be further described. The third ID list generation module checks the authority of the SP executioner information (for example, an administrator or not), and specifies a tenant ID to which the SP executioner information belongs. Further, the third ID list is generated by acquiring IDs which can be acquired by the authority of the current SP executioner information from the ID list belonging to the specified tenant ID.

In step S1107, the SSO mapping setting module 306 acquires the SSO setting request ID list (second ID list) 550 included in the fourth ID table generation request using the second ID list acquisition module 302. In addition, the second ID list is also referred to simply as “user information”.

Further, the SSO mapping setting module 306 compares the third ID list generated in step S1106 and the second ID list, and, when both match, the flowchart transitions to step S1108. If the lists do not match, the flowchart transitions to step S1111.

In step S1111, the SSO mapping setting module 306 checks whether users in the second ID list acquired in step S1107 are included in the third ID list. If the users in the second ID list are included in the third ID list, the flowchart transitions to step S1112. If no user in the second ID list is included in the third ID list, an error is returned in step S1114, and this flowchart is finished.

In step S1112, the SSO mapping setting module 306 picks up users included in the third ID list from the users included in the second ID list checked in step S1111. Further, the SSO mapping setting module 306 regenerates the second ID list, and the flowchart transitions to step S1108.

In step S1108, the SSO mapping setting module 306 performs SSO mapping processing of the second ID list. This SSO mapping processing is processing in which the fourth ID table generation module 305 sets an AUID to each user ID included in the second ID list.

In step S1109, the SSO mapping setting module 306 generates SSO mapping setting information 601 which is the fourth ID table associated with the generated AUIDs, and transmits the SSO mapping setting information 601 to the IdP.

According to the above processing, the fourth ID table (FIG. 6A) and the fifth ID table (FIG. 6B) are generated, and then the SSO mapping setting is finished.

In this SSO mapping setting, settings of AUIDs are also deleted following deletion or movement of the user ID. More specifically, when there are settings of SP User 1 and AUID 1 on the AUID mapping table, the settings of SP User 1 and AUID 1 are also deleted from the AUID mapping table following deletion of SP User 1.

In this application, an AUID may be set to each SP user at a stage at which an SP creates an SP user ID before an SSO mapping setting is requested to the SP.

When the AUID is set to each SP user before the SSO mapping setting is requested to the SP, the SP holds the table in which AUIDs are set to the SP user IDs.

Further, when the SP receives the SSO mapping setting request, the SSO mapping setting module 306 sets the AUID to each SP user ID in the second ID list using a table registered in advance.

Although the description has been made for the case where the processing in FIG. 7B is processed by one server, the processing in FIG. 7B may be realized using a system configured by a plurality of servers. When the system configured with a plurality of servers realizes the processing in FIG. 7B, each server has each module in FIG. 4A.

According to the present embodiment, it is possible to set SSO mapping to an SP ID which a user already has. Further, when an administrator serves as an agent to set SSO mapping in a tenant of a company, the administrator can serve as an agent to make an SSO mapping setting even if the agent does not know a password of each user. Further, even if a user with the same name is recreated after SSO mapping is set and after the user is deleted from an SSO target service, SSO mapping is not set by mistake.

FIG. 9 illustrates a screen example of an SSO mapping setting according to the embodiment of the present invention. In FIG. 9, an SP user ID and password, and the SSO mapping setting information 500 are received. In addition, although an IdP is also illustrated in the screen example since the SSO mapping target service is assumed to be the IdP, the SSO mapping target service is not limited to the IdP. Further, the SSO mapping setting information 500 may also be designated in a format other than a file.

In addition, although, in FIG. 7B of this application, an SP returns an error to an IdP when No is decided in step S1105, the IdP may be automatically registered. A method in which an SP automatically registers the IdP will be described using a table in FIG. 10A-10B and a flowchart in FIG. 11.

FIG. 10A illustrates a table which stores correspondences between SSO mapping target tenant IDs and IdPs in the SSO mapping service 300. This table is provided on the SSO mapping service side (SP side), and stores a tenant ID of the SSO mapping setting request and an IdP ID of the SSO mapping target. This correspondence is set prior to SSO mapping processing. In the case of FIG. 10A, the tenant A registered on the SP side corresponds to an IdP_A, and an IdP is not registered in the tenant B.

FIG. 10B illustrates a table which indicates a list of IdPs which can be automatically registered in the SSO mapping service 300. This table is provided on the SSO mapping service side (SP side). This list is set prior to the SSO mapping processing. In the case of FIG. 10B, the IdP_A and the IdP_B are IdPs which can be automatically registered.

FIG. 11 is a flowchart representing IdP automatic registration processing. When No is decided in step S1105 in FIG. 7B, the first authentication module starts the processing of this flowchart. In addition, to realize the processing in FIG. 11, IdP identification information also needs to be acquired in addition to the information described with reference to S1007.

In step S1201, the first authentication module refers to the list of IdPs which can be automatically registered in FIG. 10B.

Next, in step S1202, the first authentication module determines whether the IdP identification information is included in FIG. 10B. When the IdP identification information is not included, the first authentication module returns an error in step S1204.

When it is determined in step S**1202** that the identification information is included, in step S**1203**, the first authentication module determines that the list of IdPs can be automatically registered, and registers the IdP identification information passed in step S**1007** to the tenant ID. When, for example, the SSO mapping target tenant ID is the tenant B and the IdP_B is passed from the IdP as the IdP identification information in the status in FIG. **10**A, the IdP_B is registered as the IdP associated with the tenant B in FIG. **10**A.

Another Embodiment

Further, the present invention is also realized by executing following processing.

That is, the present invention is realized by processing of supplying software (program) which realizes the functions according to the above-described embodiments to a system or an apparatus through a network or various storage media and causing the system or the computer of the apparatus (or, for example, a CPU or a MPU) to read and execute a program.

According to the present invention, even when a user ID is deleted after SSO mapping is performed once and the same user ID is registered, it is possible to realize an adequate access.

Other Embodiments

Embodiments of the present invention can also be realized by a computer of a system or apparatus that reads out and executes computer executable instructions recorded on a storage medium (e.g., non-transitory computer-readable storage medium) to perform the functions of one or more of the above-described embodiment(s) of the present invention, and by a method performed by the computer of the system or apparatus by, for example, reading out and executing the computer executable instructions from the storage medium to perform the functions of one or more of the above-described embodiment(s). The computer may comprise one or more of a central processing unit (CPU), micro processing unit (MPU), or other circuitry, and may include a network of separate computers or separate computer processors. The computer executable instructions may be provided to the computer, for example, from a network or the storage medium. The storage medium may include, for example, one or more of a hard disk, a random-access memory (RAM), a read only memory (ROM), a storage of distributed computing systems, an optical disk (such as a compact disc (CD), digital versatile disc (DVD), or Blu-ray Disc (BD)™), a flash memory device, a memory card, and the like.

While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

This application claims the benefit of Japanese Patent Application No. 2012-126189, filed Jun. 1, 2012, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. An authentication system including a system which manages first user information and another system which manages second user information different from the first user information, the authentication system comprising:

a unique ID generation unit comprising logic configured to generate unique identification information to be associated with the received second user information,

a receiver unit comprising logic configured to receive second user information desired to be associated with the first user information from the system; and

a transmitting unit comprising logic configured to transmit a table which associates the received second user information and the unique identification information to the system;

a setting unit comprising logic configured to identify the unique identification information associated with the received second user information based on the table transmitted from the transmitting unit, and set SSO mapping by associated the first user information with the identified unique identification information,

wherein the system is configured to provide a function of the system without performing user authentication in the system based on the set SSO mapping unique identification information.

2. The authentication system according to claim **1**, further comprising a specifying unit comprising logic configured to specify a group to which a user of a user ID belongs, based on the user ID and a password received together with the user information.

3. The authentication system according to claim **2**, wherein an authority of the user ID is specified, and

the table which associates user information acquired by the authority from user information belonging to the specified group, and the unique identification information is transmitted.

4. A control method executed in an authentication system including a system which manages first user information and another system which manages second user information different from the first user information, the control method comprising:

receiving second user information desired to be associated with the first user information from the system; and

generating unique identification information to be associated with the received second user information;

transmitting a table which associates the received second user information and the unique identification information to the system;

identifying the unique identification information associated with the received second user information based on the table transmitted from the transmitting unit; and

setting SSO mapping by associating the first user information with the identified unique identification information,

wherein, the system is configured to provide a function of the system without performing user authentication in the system based on the set SSO mapping.

5. The control method according to claim **4**, further comprising specifying a group to which a user of a user ID belongs, based on the user ID and a password received together with the user information.

6. The control method according to claim **5**, wherein

an authority of the user ID is specified, and

the table which associates user information acquired by the authority from user information belonging to the specified group, and the unique identification information is transmitted.

7. A non-transitory storage medium having a program recorded thereon which causes an authentication system including a system which manages first user information and another system which manages second user information different from the first user information to:

receive second user information desired to be associated with the first user information from the system; and generate unique identification information to be associated with the received second user information;

transmit a table which associates the received second user information and the unique identification information to the system;

identify the unique identification information associated with the received second user information based on the table transmitted from the transmitting unit; and

set SSO mapping by associating the first user information with the identified unique identification information,

wherein, the system is configured to provide a function of the system without performing user authentication in the system based on the set SSO mapping.

8. The non-transitory storage medium having the program recorded thereon according to claim **7**, which further causes the system to specify a group to which a user of a user ID belongs, based on the user ID and a password received together with the user information.

9. The non-transitory storage medium having the program recorded thereon according to claim **8**, wherein

an authority of the user ID is specified, and

the table which associates user information acquired by the authority from user information belonging to the specified group, with the unique identification information is transmitted.

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